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APOLLO MONTHLY PROGRESS REPORT (U)

NAS9-150

1 November 1963

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Report Period

16 September to 15 October 1963

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PROGRAM MANAGEMENT

STATUS SUMMARY

The fully executed supplemental agreement was received from NASA during the report period. This supplemental (number 2) agreement provides for contract change authorization (CCA) requests resulting from technical directions from the Project Office representatives at Downey, WSMR, and AMR.

The F-2 test fixture was shipped to the WSMR Propulsion Systems Development Facility during the report period.

A dual drogue parachute drop test was conducted at the El Centro Naval Air Facility. The chutes were installed in a parachute test vehicle and dropped from a B-66 aircraft at an altitude of 42,000 feet. Stability of the dual drogue chutes was satisfactory.

The development phase of the Lockheed launch escape motor test firing program was completed during the report period. Qualification test firings are scheduled to begin during the next report period.

Two boilerplate land impact drop tests were successfully conducted at the Downey Impact Test Facility.

The test fixture for the Apollo centrifuge program was shipped to the Aviation Medical Acceleration Laboratory (AMAL) to be mounted in the NASA-provided centrifuge. Several astronauts participated in an engineering evaluation of the test fixture at S&ID.

SUBCONTRACTOR STATUS

Negotiations have been completed with all thirteen major subcontractors. Aeronca, Avco, Beech, Link, Lockheed, Honeywell, and Thiokol have acknowledged and returned the signed definitive purchase orders to S&ID.

S&ID and Aerojet have agreed on increased testing of the service module propulsion motor, and will change the qualification completion date from June 1964 to August 1964.

Development testing is in process on approximately 90 percent of the AiResearch components. Over-all component development testing is now approximately 85-percent complete. Subassembly testing is approximately 80-percent complete.

The new Lockheed Apollo test bay at Potrero, California, completed on 1 October 1963, was used for two successful test firings of the launch escape motor during the report period.

Since the detonation hub size and threading were identical to those of the igniter cartridge, S&ID is changing the igniter cartridge threading and size as a precautionary measure.

During the period one Pratt & Whitney fuel cell powerplant operated for 168 hours on load under vacuum conditions. This was the first operational run of an individual module under vacuum conditions.

Tower jettison motors for boilerplates 13 and 16, which were delivered to AMR during the period, are being returned to Thiokol for rework because of specification changes. They are to be returned to AMR during December.

DEVELOPMENT

AERODYNAMICS

The tower-flap configuration study to eliminate the command module apex-forward trim position during abort flight was completed. Forty-one flap configurations were considered for use in Mach numbers ranging from 0.4 to 10.0. The following conclusions were reached:

1. Elimination of the secondary (apex forward) trim position for the present adverse center-of-gravity location is not practical at hypersonic speeds (Mach numbers approximately 6.0 to 10.0).

2. The stabilizing effect of the shock waves generated by the tower flap, launch escape subsystem (LES) tower, and the command module apex interact in the region behind the center of gravity of the vehicle, inducing a very high pressure in that area, thus creating a strong stabilizing effect on the vehicle that offsets the destabilizing action of the tower flap.

It appears that a 920-square-inch planar flap located in the upper bay of the LES tower at 32 degrees incidence to the centerline of the tower, coupled with a more favorable center-of-gravity location, will be required to eliminate the problems associated with an apex-forward trim-point condition.

A study was made to determine the best means of ground testing the structural response of the service module panels and reaction control subsystem (RCS) engines to stresses resulting from the combined vibration, acoustic noise levels, and aerodynamic loads such as steady and fluctuating pressure loads during boost flight. The advisability of including a prototype RCS engine quad within the test article dictates the use of either a large transonic wind tunnel or rocket sled for the test. The 16-foot transonic wind tunnel at Langley can be used at lower cost and at an earlier date than the 35,000-foot Holloman Sled Test Track. The latter facility, however, would produce better quality test results and the over-all technical feasibility would be improved. S&ID and NASA are conducting further studies regarding the proposed testing.

MISSION DESIGN

Detailed flight characteristics for the spacecraft 009 mission (unmanned suborbital flight terminating near Ascension Island) were determined analytically, and the mission requirements and constraints on the attitude and system control programmer were established. A document for design purposes is in preparation that includes all required trajectory parameters for both normal and abort missions, suggested modifications to existing systems, and extensive supporting data to provide reference information in a single source for spacecraft 009 flight.

With minor modification to the stabilization and control subsystem (SCS) and the emergency detection subsystem (EDS), the present on-board subsystems, when coupled to an attitude and subsystems control programmer, are adequate for normal mission events and for the majority of possible launch vehicle failures. However, during some launch vehicle failures, excessive attitude changes, or excessive attitude rates may result in loss of inertial attitude reference. A study is in progress to explore the feasibility of providing a back-up attitude reference subsystem.

CREW SYSTEMS

Fabrication of the command module transit tunnel to be used for the zero-gravity docking and transfer tests was initiated. The tunnel is designed to be structurally adaptable for airborne zero-gravity tests to be conducted in a KC-135 aircraft operating from Wright-Patterson Air Force Base.

Astronaut familiarization and simulation studies using the centrifuge test fixture were conducted at S&ID during the last week of September prior to shipment of the fixture to AMAL, for use in the Phase I Apollo manned centrifuge test program scheduled to begin 28 October.

The major objectives of the S&ID centrifuge tests were as follows:

1. Checkout of the simulation mechanization and resolve interface details between the mechanization and the magnetic tape unit, the centrifuge fixture, and the test conductor's console

2. Familiarization and training for the astronauts with the controls, displays, and crew tasks associated with the Phase I program

Although the first objective was accomplished, the second objective was only partially accomplished. Additional training time will be available at Johnsville prior to data runs for the purpose of establishing a plateau in the astronaut learning curve.

Detailed information was provided to five astronauts concerning the over-all centrifuge program, entry simulation, SCS representation, command module entry dynamics, and the entry monitor system. Monitoring tasks and remedial procedures following SCS and guidance and navigation failures were described. The astronauts were also briefed on controls and displays involved in the launch/boost/abort sequence.

Eight trajectories were selected for centrifuge use to confirm crew compatibility with entry load histories corresponding to mission range requirements and mission aborts and to establish crew effectiveness boundaries and maneuver procedure load limits. The boost/abort profiles were also selected.

STRUCTURAL DYNAMICS

Investigations of command module flotation aids were made using the 1/10-scale model. It was determined that two bags attached to the parachute deck, having a total volume of 15 cubic feet, could appreciably reduce the heel angle in the second stable position. For a center-of-gravity at $X_c = 1041$, the improvement in angle was from 148 to 118 degrees, representing an increase in freeboard at the side hatch of almost three feet.

Studies were made of the feasibility of improving the heel angle in the second stable position by flooding tanks in the command module skirt area. The method would be quite effective if the center-of-gravity is reasonably low (about X_c - 1037) but is of little use when the center-of-gravity reaches X_c - 1039 or more.

A digital computer program was prepared to determine docking dynamics using the tethering concept. This method will determine tether line tension, relative closing velocity at impact, attitude at impact, and duration of the docking interval. Recent modifications to the program will permit investigation of the degree of pilot control required and the worst relative attitudes between the docking vehicles.

The S&ID program for modal, environmental, and acoustic tests scheduled for spacecraft 006 and 007 is being developed in conjunction with NASA. Schedule, objectives, justification, instrumentation, test set-up, and facilities are being reviewed. Because of the schedule exigencies, sufficient time will not be available to correct any major difficulties disclosed by the tests.

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Problems were encountered during checkout of some of the test instrumentation supplied by NASA for the 0.055 scale model Apollo vehicle used in wind tunnel tests (PSTL-2). A signal conditioner amplifier that was damaged in shipment is being repaired. Transducers furnished by one subcontractor were found to be quite temperature-sensitive and will require special care during calibration and use. The PSTL-2 test program is scheduled to start at NASA Ames Research Center on 2 December.

A 180-degree structural section, representative of the service module panels, is being acoustically tested. Initial results indicate that the structural panel modes are easily excited by the available acoustic energy although no indications of excessive structural loading were noted. The variation over the complete structure at a 138-decibel input level has been usually less than 4 decibels. No evidence of the existence of standing waves in the test chamber was found because of the large blockage effect of the test article.

STRUCTURES

The high-gain antenna in the service module is being relocated so that it will be in an area between the RCS engine plumes where heating rates will be the lowest. In the present location, heat from the RCS plumes would overheat the antenna.

The first specimen of the 45-inch-diameter service propulsion subsystem (SPS) fuel tank failed during qualification proof test. A leak developed in the tank adjacent to the lower girth weld that attaches the lower dome to the cylinder. No specific cause has yet been determined for the failure, and no design problem is indicated.

A destruction test was performed on LES tower 1. Failure occurred at 140 percent of the ultimate load in the rivets that attach the skirt to the longerons. A possible reduction of the tower insulation thickness is being investigated because of the high-failure load.

The compatibility of nitrogen tetroxide (N_2O_4) and the titanium pressure vessels is being studied. No adverse effects were observed during tests made to date, which include both internal and external impacts, close proximity explosion, and bullet penetration.

Various coatings for the interior finish of the command module were tested for outgassing products. Preliminary results show that the 3M Velvet Coating made by Minnesota Mining and Manufacturing Company is the most satisfactory in acrylic lacquer or urethane.

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Studies indicate that surface cracking of the ablator material of the command module heat shield is not considered a failure in itself. The failure criterion for the heat shield is a backface temperature in excess of 600 F. Both panel vibration and destructive beam tests will be conducted to determine whether ablator material that has surface cracks will separate from the substructure. Studies are continuing to determine the causes for the surface cracking.

FLIGHT CONTROL SUBSYSTEMS

Stabilization and Control Subsystem (SCS)

Prototype chassis panels and three subchassis panels of the attitude gyro coupling unit (AGCU) were completed by the subcontractor as follows:

1. The three subchassis panels of the master control panel of the frequency modulation (FM) model A (mode, stimulus, and monitor)

2. The electronic control assembly – AGCU chassis and the test control chassis of the FM model A

3. The stimulus control chassis and the power monitor chassis of the FM model B

A three-axis (pitch, yaw, and roll) analog study of service module abort separation was completed, and a final report was compiled. The following operational aspects of spacecraft systems, during separation from an out-of-control S-IV vehicle, were investigated:

RCS control capability
Service propulsion subsystem (SPS) control capability
Inertial measurement unit (IMU) platform reference loss
Sequencing of systems operation
Spacecraft angular excursions following separation
Crew reaction time for failure detection
Relative motion between spacecraft and booster

The major conclusions from the study are as follows:

1. The probability of loss of IMU reference is very low if SPS ignition occurs as soon as possible (60-inch clearance) after separation.

2. The IMU reference would never be lost, for reasonable crew reaction times, if SPS ignition were allowed to occur at a clearance distance of 40 inches.

3. The response of the spacecraft roll attitude control system is satisfactory, although not optimum for the abort maneuver.

4. Roll attitude control should be activated at the earliest possible time after separation.

5. The thrust vector control (TVC) subsystem, as presently configured for delta V operation, exhibits satisfactory stability characteristics and provides sufficient control capability over the spacecraft to allow recovery from large attitude excursions.

The S&ID-installed clock timer panel at the navigational station in the command module lower equipment bay will supply MIT's need for display of Greenwich Mean Time and the measurement and indication of various mission events displayed in terms of elapsed and predicted times.

Electronic Interfaces

The connector installation and mating problem between the command module lower equipment bay and the main display console was resolved by the adoption of a retracting-type connector.

A letter contract to design and manufacture the in-flight test system (IFTS) was awarded to International Telephone and Telegraph, Kellogg Communications System Division, Chicago, Illinois, during this period. The IFTS will enable the astronauts to isolate and identify possible subsystem and component failures, and will provide greater reliability with less weight than mass sparing.

TELECOMMUNICATIONS

Communications

Studies were completed and a recommendation transmitted to NASA that the S-Band transmitter output filter used to restrict the radio frequency bandwidth be deleted. Studies show that the bandwidth and signal-to-noise ratio would be within tolerances without the use of the filter. Deletion of the filter will result in a weight saving, a power output increase, and a reduction of phase jitter and frequency shift.

The performance of an engineering evaluation model TV camera, fabricated with standard electronic components instead of micromodule circuitry, is being tested. Results indicate that the system meets or exceeds the specification requirements in signal-to-noise ratio, resolution, sensitivity, gray scale rendition, and sync format.

Acceptance tests were completed on the first engineering model C-band transponder. Minor deviations from the specification were found in sensitivity, code spacing, transmitter pulse falltime, power output, and over-interrogation characteristics. This is considered typical for the engineering model stage of development and will be corrected in the flight-operational models.

NASA conducted a flight evaluation test of the VHF recovery beacon output modulation, and, as a result, requested a 15- to 25-percent increase. This increase was made, and the sine wave was revised to a square wave.

A contract was awarded for the digital up-data link equipment for spacecraft 006, 008, 011, and boilerplate 14 (house spacecraft 1). The receiver will be used with the present scimitar antenna and diplexer unit to provide the spacecraft with navigation information transmitted from earth.

Instrumentation

S&ID completed a satisfactory flight hardware design for the command module heat shield temperature measuring system. Tungsten/Rhenium thermocouple junctions (tungsten 5 percent, Rhenium/Tungsten 26 percent) were imbedded in the ablative material and temperatures were accurately measured to 4560 F. New installation and bonding processes that will not disturb the thermal characteristics of the ablator were also developed. Evaluation studies to select suitable equipment for the complete heat shield measurement system are continuing.

Flight instrumentation hardware for boilerplates 12, 13, and 23 were received during the report period. Calibration and functional testing of wholly integrated systems were completed, and the flight instrumentation is being installed in the spacecraft. Calibration and integrated functional testing of instrumentation systems are in progress for boilerplate 15.

An extensive evaluation of instrumentation sensors is being conducted to select the optimum transducers for Apollo use. Suppliers for pressure, temperature, vibration, acceleration, and strain instrumentation equipment were selected. In some cases, only one supplier had equipment capable of meeting Apollo requirements for a particular sensor application. In other cases, no equipment is available to meet these requirements. Development of such equipment is underway.

Investigations show that the F-16A Q-ball, as presently designed, would not meet the environmental requirements imposed by the addition of the LES pitch control motor. Modifications were developed to correct this condition, and the flight-qualified hardware for this modification is scheduled to be incorporated beginning with boilerplate 12.

ENVIRONMENTAL CONTROL SUBSYSTEMS (ECS)

Studies show that environmental control is required in the service module for the RCS, the SPS, and the SPS disconnect panel. A water-glycol subsystem and heater will be used for the RCS; a water-glycol subsystem will be required for the SPS; and a heater will be needed for the SPS disconnect panel.

The RCS tanks and engines are located so that some RCS quads are receiving heat from the sun while other RCS quads are losing heat by radiation to space, depending on the orientation of the vehicle with respect to the sun. If too much heat is absorbed from the sun, the temperature in the engines rises to the vaporization point of the oxidizer. If too much heat is radiated to space, the propellants will freeze. Either condition will cause a failure of an RCS quad. A water-glycol system is being developed to transport the excess heat from overheated quads to those RCS quads being overcooled. Current estimates indicate that there is a net requirement for heat input to the total system. An isotope heater is being considered for heat input. In conjunction with this heater, a space radiator will reject excess isotope heat to space when less than maximum heating is required.

The large amount of heat rejected by the fuel cells in the service module, in addition to heat radiating from the sun, causes heating of the bottom ends of the SPS propellant storage tanks, the SPS injector valve, and the gimbal rings. If this heat is not removed, overheating of the propellant tanks will occur and cause propellant vaporization resulting in possible engine failure. Overheating of the SPS injector valve or the SPS gimbal bearings also can occur and cause failures. Thus, a water-glycol cooling system is being developed to remove the excess heat from this area and to reject this heat by the use of a space radiator. Radiation of heat to space from the SPS disconnect panel can cause the SPS propellant to go well below the freezing point resulting in SPS failure. An electric heater is being developed to prevent freezing of this panel.

ELECTRICAL POWER SUBSYSTEMS (EPS)

The first two Pratt & Whitney deliverable Prototype "A" fuel cell units failed during acceptance testing because of fuel cell shorts. A thirty-one fuel cell stack that successfully passed acceptance tests is being assembled with its accessories to make a deliverable power plant and is scheduled for acceptance tests during the next period.

S&ID began manufacture of EPS radiator assemblies for spacecraft 007. Thermal analysis disclosed the necessity and indicated the feasibility of an increase in effective EPS radiator area from 32 to 48 square feet. This change will be incorporated in spacecraft 002, 006, 008, 009, and 011. Preliminary analyses indicate the need for three temperature sensing devices for each fuel cell module radiator loop to meet all mission phase requirements.

Development testing of the entry battery was completed and the design frozen. Units are being manufactured for qualification tests. Each of the two entry batteries in the command module will have 20 cells, will weigh 20 pounds, and will measure 6-1/2 inches high by 5-3/4 inches wide by 11-3/4 inches long. The batteries will be silver-oxide-zinc with a nominal 29 volts at 35 amperes. Each battery is rated at 25 ampere-hours capacity.

Both titanium- and Inconel-type pressure vessel forgings received to date failed to meet specifications. Problems were caused by low mechanical properties, large grain size, and out-of-specification chemical analysis. Machining of hemispheres from these forgings has also proved to be a major problem. To correct this situation new forging sources were developed. Second-source machining and welding subcontractors are also being developed. As a result of these difficulties, the development phase of the hydrogen and oxygen subsystems is approximately six months behind schedule.

PROPULSION SUBSYSTEMS

Service Propulsion Subsystem (SPS)

Seventy-five firings were made in the injector development program during this report period. Progress made on prototype design injectors (Doublet POUL-31-10) with ablative chambers include the following:

1. Three chambers using alternate ablative materials each accumulated a total of approximately 900 seconds. Char characteristics of these materials indicate that a lighter weight chamber may be possible.

2. A total of 867 seconds were accumulated at high inlet pressures before chamber failure occurred.

Table 1 lists all firings made during this report period.

Simulated altitude checkout firings on engine 2, at 5 and 10 seconds, were successfully conducted at AEDC. The titanium nozzle extension failed during the second firing as predicted.

The SPS fill and drain procedures and updating of the measurement requirements for test fixture F-2 and spacecraft 001 were completed. The test fixture F-2, after acceptance by NASA quality control at Downey, was delivered to WSMR.

The updating of propellant plumbing on test fixture F-3 was completed. A series of mission profile cold flow tests are in progress. Test fixture F-3 is scheduled for delivery to AEDC on 15 December.

Reaction Control Subsystem (RCS)

Prototype command module RCS engine 2023 was fired for a second mission duty cycle (approximately 275 seconds) to evaluate an "0" ring seal device between the nozzle and the nozzle extension. Preliminary studies indicate that the seal functioned satisfactorily. The engine, however, burned through the outer shell near the conclusion of the tests.

Prototype engine 8033, the first command module RCS engine to employ the production model encapsulated throat insert and the low-pressure drop injector configuration, completed approximately 136 seconds of calibration and mixture ratio survey testing. Characteristic exhaust velocity performance at nominal oxidizer-to-fuel ratio was low (86.5 percent). Slight spalling and glassing was observed in the combustion zone; the throat insert appeared to be in good condition.

Installation and checkout of the hyperflow system in the altitude simulation cell at Rocketdyne was completed. The facility is now capable of 45 minutes of continuous operation at a simulated altitude of 50,000 feet. An improved thrust cell and engine mounting system was installed.

Command module RCS fuel tank 2 was subjected to a burst pressure test. Failure occurred at a pressure of 1043 pounds per square inch gauge (psig). The specification burst pressure is 540 psig.

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Table 1. Injector Development Test Program Apollo Service Propulsion Engine

Serial Number	Pattern Type	Type of Evaluation	Number of Firings	Number of Unstable Firings	Total Time (sec)	Remarks
AFF-6	Doublet, POUL 41-4	Injection/chamber compatibility	2	0	153.1	Satisfactory
AFF-12	Doublet, POUL 31-10	Alternate material	9	0	1592	Satisfactory
		P_o and mixture ratio survey	10	0	978.5	Chamber wall irregular at throat
AFF-14	Doublet, POUL 31-10	Alternate material	5	0	902	Total time on chamber = 902 seconds
		Prototype determination	22	0	867	Firings conducted at high inlet pressures. Total time on Chamber = 867 seconds. Chamber burn-through during last firing.
AFF-15	Doublet, POUL 61-4	C*	1	0	3.3	Weld cracks on backside of injector. Injector face brace cracks
AFF-20	Doublet, POUL 31-10	Columbium nozzle evaluation	1	0	5.5	Stubby nozzle failed during start
AFF-21	Doublet, POUL 31-10	C*	2	1	2.77	Cracks in injector fuel manifold and pie section
AFF-17	Doublet, POUL 31-17	C*	15	4	61.5	Three firings with header braces installed
AFF-23	Doublet, POUL 31-10	C*	1	0	5.4	Satisfactory
AFF-37	Doublet, POUL 31-10	Checkout of C-11 test stand	1	1	2.6	CSM shutdown attributed to AGC installation. Fuel inlet line weld crack
AEDC 2	AFF-4	Simulated altitude	2	0	15	Satisfactory
BF-17	Doublet, POUL 31-3	C*	1	0	5.11	Damage to baffles and inner can
BF-19	Doublet, POUL 41-1	Induced instability	5	0	28.9	One firing with M_2 injection. Four firings with pulses of 4.6, 6.9, 13.6, and 14.5 grains.
		C*	2	0	11.2	Satisfactory
		Injector/chamber compatibility	2	0	40.4	Satisfactory

C* = Characteristic exhaust velocity

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Contract negotiations are nearly complete for the propellant quantity gauging system. The system will incorporate integrated circuits to reduce the number of components in the system.

An experimental service module RCS test program was begun to find a solution to the combustion chamber burnthrough and fracturing problems. No burnthrough was experienced on the three configurations fired under conditions which previously had resulted in chamber burnthrough. Analysis of the test results is in progress.

Marquardt experienced a service module RCS engine combustion chamber fracture on the third pulse of a series of pulses initiated with the chamber expansion nozzle cooled to -100 F. Although the combustion chamber and the throat were shattered, the expansion nozzle remained intact. The engine configuration was the 12-on-12 prototype design. Preliminary studies indicate that the failure was caused by a high-pressure spike at ignition.

The command and service module RCS test point coupling component design was reviewed, and inadequate seal provisions were discovered. Design changes were initiated to correct this condition.

<u>Launch Escape Subsystem (LES) Motors</u>

The hotwire ignitor cartridge design was frozen for the LES and pitch control motors. The cartridge selected for use with these two motors is a 2100 pounds per square inch, 600 calorie design. Design of the tower jettison hotwire igniter cartridge is being modified to produce a cartridge that will have a pressure-time curve similar to the exploding bridgewire and that will prevent excessive ignition delay when fired in the pyrogen units. Positive steps were taken to preclude the accidental use of Apollo separation detonators in place of hotwire igniter cartridges, or the use of the cartridges designed for the tower jettison motor in place of the LES or pitch control motor cartridges or vice versa. This is accomplished by the use of the following cartridge thread sizes: 9/16-18 UNF thread for the separation detonators; 3/4-16 UNF for the tower jettison motor cartridges; and 5/8-18 UNF for the LES and pitch control motor cartridges.

The Phase I development program of both the LES and the pitch control motors was completed. The Phase II qualification program is scheduled to begin in early November. The tower jettison motor development program should be completed during the next report period, and the qualification phase should start in mid-December.

DOCKING AND EARTH LANDING

Docking simulation test vehicle 2 and the last of the four different extendible docking mechanisms are being fabricated. An S&ID facility is being readied for the docking simulation tests of the four extendible docking mechanisms and one impact subsystem. Test vehicles 1 and 2 will use air film for mobility. A crew task analysis mock-up is being designed that will employ a similar air film vehicle with a five-degree-of-freedom simulation.

The crushable rib configuration of boilerplate 2 is being modified to approximate that of a spacecraft. Boilerplate 1 will also be modified, based on the outcome of landing impact tests with boilerplate 2.

Drop tests 53, 54, and 55 were conducted with boilerplate 1. The crew couch shock struts functioned within design tolerance. In drop test 54, the x-x axis couch attenuation struts again bottomed in compression. Corrective measures are being taken. In drop test 55 the vehicle did not tumble and the heat shield was severely damaged. The vehicle is being repaired.

NASA will provide emergency crew tolerance specifications, and S&ID will incorporate a lock-out mechanism on the x-x crew couch attenuation struts. If possible, the lock-out unit will function automatically. This unit will prevent inadvertent stroking of these struts during high-g flight loads.

Studies are in progress to develop a crew couch strut system that will keep crew accelerations below nominal levels for all landing conditions. Apparently, such a system can be devised if the on-set rate is permitted to exceed nominal, but not emergency, limits for certain combinations of landing parameters.

The dye marker ejection mechanism for water landings was deleted by moving the dye to the aft heat shield area where water seepage will quickly disperse the dye at vehicle impact on water.

Wind tunnel tests of scale model parachutes are in progress. Proposals that would result in significant weight reduction in the parachute subsystem are being studied.

Investigation of the boilerplate 3 failure was completed and results reported to NASA. Rigging and design changes resulting from the investigation of the boilerplate 3 parachute subsystem failure were completed on boilerplate 19. Stowage problems were encountered because of the addition of the protective sleeves that increased the size and stiffness of risers and harness. To relieve this problem, it will be necessary to change the harness by deleting the upper legs and shortening the four lower legs. This, in turn, will require that the main chute risers be attached directly to the upper side of the clevis fitting. These rigging and design changes will also be made on boilerplate 6.

GROUND SUPPORT EQUIPMENT (GSE)

All GSE items for boilerplate 6 were completed with a modification of the LES weight and balance fixture, which was accomplished on-site at WSMR. Of the 99 GSE items required for boilerplate 12, there are 19 completed and ready for NASA acceptance inspection. The majority of the remaining GSE items are scheduled for completion during the next period. GSE designs are complete, and all GSE items will be completed during December.

The digital test command system breadboard 1 was completed and accepted by NASA.

The rerouting of wires in the pulse code modulation (PCM) response subsystem has reduced, by approximately 50 percent, the 51.2-kilocycle clock noise on the lines from the C14-230 to the C14-210 and C14-240 interleavers. The noise level of the analog signals being digitized was decreased by improved grounding techniques. Tests are being conducted to determine whether the present noise rejection is within the specified tolerances.

Rework to correct deficiencies in the present PCM subsystem is under way; four units are scheduled for delivery to S&ID during the next period.

Engineering drawings are nearly complete for the propulsion subsystem fluid checkout unit. Twelve of the 14 ICD's required for the configuration were completed and 2 of a required 17 drawings are nearly complete.

SIMULATION AND TRAINERS

The Apollo mission simulator (AMS) program was reviewed at a meeting attended by NASA, S&ID, and Link. S&ID presented the Apollo mission program, and Link gave definitions of tasks and criteria for the AMS software. The AMS schedule was reviewed. Detailed studies were made regarding trajectories, the stabilization and control subsystem, mission planning, digital programming, logistics, the AMS PERT chart, and the Link procurement program, in-house work load, and organization.

Revisions are being made in the AMS and the Apollo part task trainer (APTT) PERT charts to conform with NASA requests.

The basic structure of the APTT is complete, and panels are being fitted to the structure. The design of the environmental control, attitude control, and communications subsystems were frozen and detailed electronic design was begun.

Release of the drawings for the APTT instructor station console was initiated. Procurement of the console structure and in-house manufacture of the subpanels was begun.

The status of the AMS instructor station console at Link is about the same as that for the APTT at S&ID. All their panel drawings were approved by S&ID and are being submitted to NASA for approval.

NASA accepted the simulator and evaluator study program that sets forth schedules and objectives. S&ID will furnish NASA the specification and the delivery schedules for the evaluator complexes for the Apollo simulation program.

PROJECT INTEGRATION

Studies reveal that the original plan to use the preflight automatic checkout equipment (PACE) carry-on equipment for the spacecraft 008 environmental chamber tests is not feasible. PACE was designed for spacecraft checkout. Its use for spacecraft 008 test operations would require the addition of 10 modules of 25 signal conditioners each to meet the test requirements established that are peculiar to spacecraft 008. Further, the PACE equipment would need to be redesigned to be thermally neutral (no heat absorbed or emitted) and be capable of operating in the crew compartment environment of 5.0 psia and 100-percent oxygen. Also, the size of the PACE equipment would interfere with crew test operations.

S&ID is preparing a detailed alternate plan that will eliminate the need for PACE for spacecraft 008 tests. Low-level transducers and signal conditioners used in conjunction with the flight qualification pulse amplitude modulation (PAM) equipment and a hardwire cable will replace the PACE carry-on equipment and its hardwire lines.

VEHICLE TESTING

The boilerplate 6 program has been adversely affected because of the modifications required as a result of the failure of the boilerplate 3 parachute subsystem and the destruction of the vehicle on earth impact.

Necessary structural changes to the command module consisted of an obstacle reduction in the forward compartment and provisions for guards over the pilot chute mortar cans. Necessary changes to the parachute subsystem consisted of the addition of protective sleeves for the risers and the harnesses, the shortening of the main chute harness by approximately 10 feet, and the deletion of the main chute disconnect and keeper. All of these changes were designed to reduce the possibility of abrading or cutting

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of the parachute system fabric or lines. All structural changes were completed by the end of September, and the parachute changes should be completed during the next period.

Boilerplate 12 is being updated to incorporate approximately 11 changes. It is scheduled to be launched following boilerplate 6 as next in the series of abort tests. Boilerplate 12 is designed to test high-q abort.

Boilerplate 13 is the first Apollo launch vehicle test to be flown from AMR. Its basic mission is to obtain launch environmental data to be used for the verification of the design criteria. Final assembly of the service and command modules and the launch escape subsystem including instrumentation installation is nearly complete. Intermodule fit checks and power-on checks are scheduled for completion so that the vehicle may be presented for the NASA design engineering inspection (DEI) during the next period. Following the DEI, the vehicle will be ready for Apollo Test Operations.

RELIABILITY

A reliability assessment of mission success and total operations was completed for boilerplates 6, 12, and 13. The results are given in Table 2 in three categories of data as follows:

1. Predicted (based on state-of-the-art hardware)

2. Assessed (based on test results to date)

3. Projected (based on the assessed reliability plus assumed success on all tests scheduled between now and launch).

The analysis was completed for each of the primary mission objectives, and a summary is listed in Table 2 by mission success and total operations for each boilerplate.

Instrumentation for these boilerplates is predominantly government-furnished equipment, with few test results available to S&ID; also, GSE test results are not available at the present time. Therefore, predicted values for this equipment were used in computing the assessed and projected reliabilities. Over-all assessed and projected reliabilities are considered somewhat pessimistic as the data used contains a considerable number of early development failures.

Total operations include mission success plus the probability of successfully completing the countdown. This countdown is 4 hours for boilerplate 6 and 6 hours each for boilerplates 12 and 13.

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Table 2. Summary of Reliability Analysis of the Primary Mission Objectives

Boilerplate	Operation	Probability of Success		
		Predicted(%)	Assessed(%)	Projected(%)
6	Mission success	96	71	72
	Total operations	86	62	63
12	Mission success	98.2	77	85
	Total operations	93	69	78
13	Mission success	98.7	91	92
	Total operations	91	79	83

TECHNICAL OPERATIONS

The present status of the interface control documentation, presented in Table 3, shows a total of 570 interface control documents (ICD) identified as of 15 October. Of this total, 14 are approved by NASA, 39 are approved by S&ID, and 15 of 195 applicable ICD's are approved by associate contractors. Of the 54 ICD's affecting MIT, 13 have received all necessary signatures and 12 additional ICD's were approved by S&ID; 1 of these ICD's was also approved by MIT. The single ICD affecting Convair has all necessary signature approvals.

Changes in the total number of identifiable ICD's is accounted for by the deletion of a total of 32 ICD's that are no longer considered necessary, and the addition of 62 newly created ICD's affecting Grumman, 2 additional for MIT, and 4 for Hamilton Standard.

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Table 3. Interface Control Documentation Status Report
Through 15 October 1963

Associate Contractor	Total ICD's Identified	Approved by NASA	Approved by S&ID	Approved by Associate Contractors
NASA (MSC) Electrical Systems Division	22 (18 deleted)	0	0	
NASA (MSC) Crew System Division	1	0	0	
NASA (MSC) AMRO	207	0	1	
NASA (MSC) Propulsion System Development Facility	21 (2 deleted)	0	5	
NASA (MSC) Mission Abort Facility	2	0	0	
NASA Inter-Center	122 (12 deleted)	0	5	
MIT	54 (was 52)	13	25	14
General Dynamics-Convair	1	1	1	1
Hamilton Standard	32 (was 28)	0	0	0
Grumman	108 (was 46)	0	0	0
Totals	570	14	37	15
Last Month's Totals	534	14	39	14

OPERATIONS

DOWNEY

The boilerplate 12 flight test instrumentation was completed except for the Microdot temperature simulator not yet received from NASA. Fabrication of junction boxes and cables for the boilerplate 12 "Little WSMR" test preparation activities continued.

The boilerplate 13 calorimeters, zone-boxes, and "inaccessible" instrumentation have been installed in the boilerplate. Upon completion of the instrumentation installation, a DITMCO checkout of the service module and adapter was completed.

The boilerplate 15 command module breadboard cabling continuity checkout has been completed, and the installation and checkout of the breadboard instrumentation equipment is nearing completion.

The detailed GSE and MSC environmental proof test facility requirements for support of spacecraft 008 testing were established at the program review meeting at MSC during the period.

During the next period, test preparation on boilerplates 12 and 13 will be completed, and checkout will be started.

WHITE SANDS MISSILE RANGE

The modification to the boilerplate 6 command module top deck caused by the boilerplate 3 parachute drop test, failure has been completed. A fit-check of the reworked Northrop-Ventura parachute subsystem to be used for boilerplate 6 disclosed an increase in configuration size of the chute harness. Because this increase in volume resulted in a parachute harness stowage problem, the main and drogue chute harnesses were shortened in order to resolve the stowage problem. The parachute subsystems were then again fit-checked on boilerplate 19 and shipped to WSMR. These parachutes are being installed in the command module.

The PSDF test area control center floors, duct work, partition, electrical conduits, and equipment installation are in progress. The GSE terminal room has been completely poured and waterproofed. The test stand has been completed and is awaiting the structural steel and deflector installation. The water treatment plant and GSE shelter room concrete work has been completed, and work is in progress on the test stand pad, electrical conduits installation, and the flume guniteing. The test stand 2 mass excavation has been completed, including the tunnel excavation from test stand 2 to the control center.

Test fixture F-2 receiving inspection and functional checkout will be completed during the next period. The fixture will be moved to the PSDF and installed on the test stand.

Boilerplate 6 is scheduled to be prepared for countdown and launched during the next period.

ATLANTIC MISSILE RANGE

The PACE/spacecraft display requirements for spacecraft 011 measurements have been formulated, documented, and transmitted to NASA. Preparation of the stimuli requirements has been started. A review of the boilerplate 13 operations schedule has been completed and transmitted to NASA.

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FACILITIES

DOWNEY

Systems Integration and Checkout Facility

The assignment of additional manpower to duct insulation work has expedited this phase of the project. Rough electrical installation is on schedule. Roofing was begun last week and is approximately 75-percent complete. The total project is approximately 65-percent complete.

Space Systems Development Facility

The ECS contractor is on schedule. The main building contractor has completed the walls for the acoustic facility. The shock simulation block was poured on October 3, as scheduled. This portion of the building is approximately 16-percent complete.

INDUSTRIAL ENGINEERING

Location of the Apollo tube cleaning facility will be in the centralized processing area to be relocated from the flight test area. Installation design work is on schedule for occupancy on 1 January 1964.

Briefings and technical data were presented to NASA supporting the plan to manufacture the S-IVB adapter at the Tulsa facility.

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S&ID Schedule of Apollo Meetings and Trips
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
Boilerplate 6 coordination	WSMR	16 September	Pearce	S&ID, NASA
Propellants and gases sub panel meeting	AMR	16 September	Yim, Grycel, Barajas	S&ID, NASA
Boilerplate 12 - Special Problems Coordination	WSMR	16 September	Shaw	S&ID, NASA
Trajectory sub panel meeting	Houston, Texas	16 September	Myers, Meston	S&ID, NASA
Follow-up on problem areas	Buffalo, New York	16 September	Hobson	S&ID, Bell Aerosystems
Engineering coordination	Sacramento, California	16 September	Thurman	S&ID, Aerojet-General
Coolant system and atmospheric control problems discussion	Houston, Texas	16 September	Stelzriede, Stoll, Reithmaier, Adlestone	S&ID, NASA
NASA-S&ID working meeting	Houston, Texas	16 September	Hatcher, Gregory, Frazier	S&ID, NASA
Coordination/MIT future effects analysis	Cambridge, Massachusetts	16 September	Fatton, Hebert	S&ID, MIT
Wind tunnel aero-dynamics tests	Tullahoma, Tennessee	16-17 September	McNary, Miller	S&ID, NASA
Backup gimbal actuators procurement	Sacramento, California	17 September	Field, Ross	S&ID, Aerojet-General
Contractual and technical problems resolution	Shawnee, Oklahoma	17 September	Saindon, Farrell, Sclabassi, O'Hearn, Weir, Avery	S&ID, Shawnee Industries
RFI testing discussions	Houston, Texas	17 September	Frankos, Pumphrey	S&ID, NASA
Preliminary technical discussions	Houston, Texas	17 September	Clary, Gustavson, Robinson	S&ID, NASA
Design review	San Carlos, California	18 September	Augsburg, Hitchens, Glavinich, Lazarus, Whitted	S&ID, Pelmec
Apollo investigation tests for NASA	Mountain View, California	18 September	Crowder	S&ID, NASA
CSM briefing	Houston, Texas	18 September	Rooten, Sweet	S&ID, NASA
Design review survey	San Carlos, California	18 September	Hitchens	S&ID, Pelmec
Design and schedule review	Melbourne, Florida	18 September	Whitehead	S&ID, Radiation

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
Design review	San Carlos, California	18 September	Augsburg, Glavinich, Lazarus	S&ID, Pelmec
Alternate AGCU feasibility studies review	Minneapolis, Minnesota	18 September	Kalayjian	S&ID, Honeywell
Lunar excursion module/ adapter access and handling requirements working group	Bethpage, Long Island, New York	18 September	Richardson, Crisell, Myers, Henry, Hillberg, Yim	S&ID, Grumman
Wind tunnel test	Tullahoma, Tennessee	19 September	Bornemann, Kubota	S&ID, NASA
Lunar excursion module GSE command usage meetings	Bethpage, Long Island, New York	20-23 September	Corvese, Hemond, Fisher, Samuelson	S&ID, Grumman
Subcontractor field analysis	Phoenix, Arizona	22 September	Blakely, Covington, Shear, Fuller, Hagelberg	S&ID, Motorola
Monthly coordination meeting	Rolling Meadows, Illinois	27-29 September	Schiavi, Covington, Cason	S&ID, Elgin National
Coordination meeting with NASA, Grumman, Hamilton-Standard	Houston, Texas	22 September	Tarr, Ross, Roentgen, DeWitt	S&ID, NASA
Quarterly status briefing	Lowell, Massachusetts	22 September	Lowery, Powers	S&ID, Avco
Field analysis for definitive purchase order	Scottsdale, Arizona	22 September	Hagelberg, Blakely, Shear, Fuller, Covington, Hove	S&ID, Motorola
Design review of AMS	Binghamton, New York	22-23 September	Dudek, Marshall, Premo, Fairchild, Frimtzis, Matthews, Rosen, Robbins, Pollard, Kerr, Cole	S&ID, Link Division
New start procedure review	Hartford, Connecticut	22 September	Scott	S&ID, Pratt & Whitney
AIA electromagnetic interference panel meeting	Dayton, Ohio	22 September	Robinson	S&ID, USAF
NAA-Avco coordination meetings	Lowell, Massachusetts	22 September	Morant	S&ID, Avco
Engine testings	Sacramento, California	22 September	Mower	S&ID, Aerojet-General

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
Acceptance tests	East Hartford, Connecticut	22 September	Cooke	S&ID, Pratt & Whitney
Pellet basket firings	Elkton, Maryland	22 September	Yee	S&ID, Thiokol
Proposal negotiation	Joplin, Missouri	23 September	DeVries, Briggs, Otzinger, Parry, Muirisse	S&ID, Eagle-Picher
Quarterly status briefing and technical interchange meeting	Lowell, Massachusetts	22-24 September	Hanifin, Johnson, Kinsler, Confer, Nelson, Gershun, Statham, Powers	S&ID, Avco
Liaison	Oak Ridge, Tennessee	23 September	McCleary	S&ID, Oak Ridge National Laboratory
Rocket sled test conference	Alamogordo, New Mexico	23 September	Davey	S&ID, NASA
NASA and S&ID coordination	Houston, Texas	23 September	Akers, Bailey, Osbon, Carroll	S&ID, NASA
Technical coordination on GSE	Tarrytown, New York	23 September	Bankson	S&ID, Simmonds
S-IVB adapter facilities briefing	Houston, Texas	23 September	Mundy	S&ID, NASA
Apollo crew systems	Houston, Texas	23 September	Brewer, Beam, Wells, Winkleman	S&ID, NASA
GOSS systems meeting	Houston, Texas	23 September	Strelow, Koos, Santucci, Chiavacci, Kiehlo	S&ID, NASA
GSE acceptance point discussions	Houston, Texas	23 September	Sack	S&ID, NASA
Mission simulator technical review	Binghamton, New York	23-24 September	Hatchell, Kerr, Banta	S&ID, General Precision
Quarterly status briefing	Lowell, Massachusetts	24 September	Smith	S&ID, Avco
Cryogenic destratification system discussion	Cambridge, Massachusetts	23 September	Haglund, Krainess, Carter	S&ID, Dynatech
Design review meeting	Cedar Rapids, Iowa	23 September	Moore, Oleson	S&ID, Collins
GSE coordination for SPS engine	Sacramento, California	24 September	Alpert, Goodzey, Jorgensen	S&ID, Aerojet-General

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
Coordination meeting	Sacramento, California	24 September	Borde	S&ID, Aerojet-General
N&G systems meeting	Cambridge, Massachusetts	24 September	Johnson, Knotts	S&ID, MIT
Tooling coordination	Wilmington, Massachusetts	24 September	Lacy	S&ID, Avco
Quarterly management status briefing	Wilmington, Massachusetts	24 September	Kiefer	S&ID, Avco
AGE-5A installation meeting	Cambridge, Massachusetts	24 September	Cauble, Kasten, Ritchie	S&ID, MIT
S-IVB adapter presentation	Houston, Texas	24 September	Paup, Johnson	S&ID, NASA
Quarterly status briefing	Wilmington, Massachusetts	24 September	Hanifin, Johnson	S&ID, Avco
Quality control problems coordination	AMR	24 September	Griffith-Jones	S&ID, NASA
Quality control problems coordination	Houston, Texas	24 September	Griffith-Jones	S&ID, NASA
Quarterly management briefing	Wilmington, Massachusetts	24 September	Mihelich	S&ID, Avco
Apollo program coordination	Sacramento, California	25 September	Ross, Simkin, Goldstein, McNamara	S&ID, Aerojet-General
Facilities status review	AMR	25 September	Standiford	S&ID, NASA
Development program and design review meeting	Dayton, Ohio	25 September	Bratfisch, Moreno	S&ID, United Aircraft
Functional time flow diagrams discussion	Houston, Texas	25 September	Edsiak, Gerry, Anderson	S&ID, NASA
ASPO management briefing	Houston, Texas	25 September	White	S&ID, NASA
Design review	Elyria, Ohio	25 September	Sass, Butler, Leonard, Whitted, Glavinich	S&ID, Lear
Technical design discussion	Southhampton, Pennsylvania	25 September	Sturkie	S&ID, Vector Manufacturing
Boilerplate 9 modification	El Centro, California	25 September	Widener, Frost, Jost	S&ID, Northrop-Ventura
Static firing review	AMR	29 September	Wright, Smith	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
Sled tests conference	China Lake, California	26 September	Snowden, Critchley	S&ID, China Lake Naval Ordnance Test Station
Boilerplate 6 coordination	WSMR	26 September	Fugikawa	S&ID, NASA
Change control procedure briefing	Houston, Texas	26 September	Templeton	S&ID, NASA
Boilerplate 6 modification	WSMR	26 September	Bean, Gibbs	S&ID, NASA
Coordination meeting	Indianapolis, Indiana	27 September	Tapper, Westfall, Brehault, Krainess, Gardiner	S&ID, Allison
Parachute installation support on boilerplate 19, boilerplate 6	El Centro, California, WSMR	27 September	Byrd	S&ID, NASA
Site coordination meeting	AMR	27-29 September	Reed, Bonsack, Hemond	S&ID, NASA
Area checkout preparation	AMR	27 September	Shroble, Watkins, Crozier	S&ID, NASA
Ringsail parachute tests	Mountain View, California	28 September	Biss, Emerson	S&ID, Ames
Apollo briefings	Washington, D. C.	28 September	Paup, McCarthy, Laidlaw	S&ID, NASA
Centrifuge study setup and checkout	Johnsville, Pennsylvania	28 September	Gonzalez, Stoddard	S&ID, Aero-Medical Acceleration Labs
Field analysis	Cedar Rapids, Iowa	28-30 September	Hagelberg, Albinger, Doll, Shear, Chapin	S&ID, Collins
Monthly coordination meeting	Indianapolis, Indiana	29 September	Tapper, Westfall, Brehaut, Krainess, Gardiner, Young, Duttenhofer	S&ID, Allison
Static firing review	AMR	29 September	Wright, Nielson, Smith	S&ID, NASA
Witness firings and review data on tests	Sacramento, California	29 September	Mower	S&ID, Aerojet-General
Engineering coordination	Boulder, Colorado	29 September	Meyer	S&ID, Beech Aircraft

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
Field analysis	Cedar Rapids, Iowa	29 September	Hagelberg, Doll, Shear, Albinger, Fuller	S&ID, Collins
Parachute wind tunnel program support	Moffett Field, California	29 September	Trebes	S&ID, Ames
Monthly EPS meeting	Houston, Texas	30 September	Nelson, Nash, Thomas, Bouman	S&ID, NASA
Wind tunnel testing	Moffett Field, California	30 September	Yost, Large	S&ID, Ames
Apollo lunar landing mission meeting	Houston, Texas	30 September	Rosen, Abramson	S&ID, NASA
Establish GSE requirements on spacecraft 008	Houston, Texas	30 September	Embody, Zuckerman Barajas, Celia, Clauder, Hodiak	S&ID, NASA
Feasibility of conducting wind tunnel tests discussion	Hampton, Virginia	30 September	Allen, Stevens	S&ID, Langley Research Center
Redraw PERT network and management coordination visit	Boulder, Colorado	30 September	Carter, Hawken	S&ID, Beech Aircraft
Environmental program meeting	Houston, Texas	30 September	Embody, Wellens	S&ID, NASA
ELS system on boilerplate 6 modification	WSMR	30 September	Canclini	S&ID, NASA
Engineering liaison	WSMR	30 September	Teter	S&ID, NASA
Boilerplate 6 schematics change verification	WSMR	30 September	Mattson	S&ID, NASA
SPS coordination	Sacramento, California	30 September	Borde, McNamara	S&ID, Aerojet-General
Monitor parachute drop tests	El Centro, California	30 September	Young, Duffy	S&ID, Naval Air Facility
Test preparation on boilerplate 6 supervision	WSMR	30 September	Pearce	S&ID, NASA
Acceptance tests observation	Melbourne, Florida	30 September	Rosenthal	S&ID, Radiation
Test requirements coordination	Buffalo, New York	30 September	Hobson, Whiting	S&ID, Bell Aero-systems
S&ID-NASA simulation program orientation	Houston, Texas	1 October	Rovelsky	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
Process specification technical review	Boston, Massachusetts	1 October	Molden, Garringer, Campbell	S&ID, Honeywell
Obtain lunar excursion module shielding configuration data	Long Island, New York	1 October	Schaedle	S&ID, Grumman
Structural-mechanical systems meeting	Houston, Texas	1 October	Johnson, Underwood, Roberts	S&ID, NASA
Weight and balance equipment rework	WSMR	1 October	McGee	S&ID, NASA
Astronaut design mission plan briefing	Houston, Texas	2 October	Smith	S&ID, NASA
RCS thrust level and vector discussion	Hampton, Virginia	2 October	Hackett	S&ID, Langley Research Center
Simulator meeting configuration and operation	Dayton, Ohio	2 October	Tribble	S&ID, NASA
Packaging and transportation coordination and development	WSMR	2 October	Stanfield, Robinson	S&ID, NASA
AT&O support	WSMR	2 October	Phillips	S&ID, NASA
Tumbling dynamic test program discussion	Mountain View California	2 October	Takvorian, Udvardy	S&ID, Ames
G&N systems meeting	Houston, Texas	2 October	Hedvig, Goldman	S&ID, NASA
Propellant valve and alternate chamber progress review	Sacramento, California	2 October	Field, Ross	S&ID, Aerojet-General
Coordination and review	Sacramento California	3 October	Cadwell	S&ID, Aerojet-General
Parachute drop tests observation and monitoring	El Centro,	3 October	Young	S&ID, NASA
Boilerplate 19 modification	El Centro, California	4 October	Brayton	S&ID, Northrop-Ventura
Acceptance testing	Melbourne, Florida	4 October	Symm	S&ID, Radiation
PERT network updating and revision	Hartford, Connecticut	6 October	Symons	S&ID, Pratt & Whitney
Apollo manned centrifuge program	Johnsville, Pennsylvania	6 October	Staniec	S&ID, AMAL
Centrifuge fixture installation	Johnsville, Pennsylvania	6 October	Bazell	S&ID, AMAL

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
F-2 facilities discussion	WSMR	6 October	Bellamy, Field, Gallanes	S&ID, NASA
Propulsion meeting	Houston, Texas	6 October	Bellamy, Field, Gallanes	S&ID, NASA
SPS engine test program review	Tullahoma, Tennessee	6 October	Field	S&ID, NASA
PERT coordination	Scottsdale, Arizona	6 October	Covington, Studen	S&ID, Motorola
GSE support of handling and auxiliary equipment	WSMR	6 October	Schneider	S&ID, NASA
Modal, environmental vibration, and acoustic test plan review	Houston, Texas	7 October	Lassen, Stevens Kinnear, Dreschler	S&ID, NASA
Wind tunnel testing	Moffett Field, California	7 October	Kaiserauer, Large	S&ID, Ames
GSE support of handling and auxiliary equipment	WSMR	7 October	Frank	S&ID, NASA
Controls and displays, mechanization, and check-out requirements review	Minneapolis, Minnesota	7 October	Codding	S&ID, Honeywell
Boilerplate 19 weight and balance determination	El Centro, California	7 October	Brayton, Hedger, Kessler	S&ID, NASA
SCS task analysis coordination	Minneapolis, Minnesota	7 October	Susser	S&ID, Honeywell
SPS coordination	Sacramento, California	7 October	McNamara	S&ID, Aerojet-General
Bench maintenance equipment coordination	Cedar Rapids, Iowa	7 October	Marine, Nourse	S&ID, Collins
F-2 GSE Propulsion system Development Facility reliability coordination	WSMR	7 October	Tropila	S&ID, NASA
Boilerplate 19 modification	El Centro, California	7 October	Gibbs, Widener	S&ID, NASA
Boilerplate 6 flight tests coordination and liaison	WSMR	7 October	Dunham	S&ID, NASA
Bench test procedure planning	AMR	7 October	Humphrey	S&ID, NASA
Checkout panel meeting	Houston, Texas	7 October	Cooper	S&ID, NASA
NASA docking analog studies review	Houston, Texas	8 October	Bohlen	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
Off-loaded CSM feasibility studies for SI-B flights discussion	Houston, Texas	8 October	Neatherlin	S&ID, NASA
Apollo program review	Houston, Texas	8 October	Ryker, Perkins	S&ID, NASA
Thermal interface engineering coordination meeting	Cambridge, Massachusetts	8 October	Percy, Reithmaier, Ciocca	S&ID, MIT
Engineering conference	Bayshore, New York	8 October	Percy, Reithmaier, Ciocca	S&ID, Stratos-Fairchild
Phase response test	Cedar Rapids, Iowa	8 October	White	S&ID, Collins
Apollo mission planning panel meeting	Houston, Texas	8-9 October	Myers, Milliken, Goldman, Robertson	S&ID, NASA
Acceptance test procedures review	Cedar Rapids, Iowa	8 October	Milham	S&ID, Collins
Controls and displays review	Minneapolis, Minnesota	8 October	Campbell	S&ID, Honeywell
Apollo checkout panel	Houston, Texas	8-9 October	McMullin, Gebbart, Stearns	S&ID, NASA
Cost reduction and design review	Paramus, New Jersey	9 October	Hagelberg, Pope	S&ID, A. C. F. Electronics
Measurement requirements coordination	Houston, Texas	9 October	Schmitz, Gresham	S&ID, NASA
Engineering liaison	WSMR	9 October	Teter	S&ID, NASA
Boilerplate 6 parachute installation support	WSMR	9 October	Byrd	S&ID, NASA
Apollo systems trainer design review	Houston, Texas	9 October	McIntyre, Lambert, Elderkin, Hanlon, Steisslinger, Pfanner	S&ID, NASA
Quality control survey	Baltimore, Maryland	9 October	Toomey, Walsh	S&ID, Martin
Monthly design meeting	Melbourne, Florida	9 October	Britton, Sublett, Baldwin, Rutkowski	S&ID, Radiation
Propellant valve review	Sacramento, California	9 October	Ross, Field, Cadwell	S&ID, Aerojet-General
Design review	Paramus, New Jersey	9 October	Hagelberg, Fuller, Shear, Kronsberg, Pope	S&ID, A. C. F. Electronics
C-band transponder design review meeting	Paramus, New Jersey	9 October	Hagelberg, Shear, Fuller, Mihelich, Kronsberg	S&ID, A. C. F. Electronics

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
SPS static firing requirements presentation	AMR	9 October	Shelley, Monfort	S&ID, NASA
Environmental test requirements coordination	Houston, Texas	9-10 October	Shelley, Monfort, Siwolop	S&ID, NASA
PCM subsystems coordination	Metuchen, New Jersey	10 October	Musso, Bradanini, Bunge	S&ID, Applied Electronics
Test data flow establishment	WSMR	10 October	Parsons, Trott, Stearns	S&ID, NASA
GSE common usage meeting	Bethpage, Long Island, New York	10-13 October	Siwolop, McMillin, McMullin, Jesch, McNerney, Corvese	S&ID, Grumman
Acceptance testing	Melbourne, Florida	11 October	Symm	S&ID, Radiation
Boilerplate 6 operations engineering support	WSMR	12 October	McFarland	S&ID, NASA
Technical discussions	Hartford, Connecticut	12-13 October	Snyder, Schaefer	S&ID, Pratt & Whitney
Design review	Cleveland, Ohio	13 October	Sass, Butler	S&ID, Lear-Siegler
SCS bench maintenance equipment configuration control drawings coordination	Minneapolis, Minnesota	13 October	Colacion	S&ID, Honeywell
Lunar excursion module gear design configuration coordination	Bethpage, Long Island, New York	13 October	Dullea	S&ID, Grumman
Motion simulator design review	Parsipenny, New Jersey	13 October	Hardaway, Rovelsky, Sclabassi	S&ID, Thiokol
Configuration and interface control manning requirements review	AMR	13 October	Highland	S&ID, NASA
Spacecraft 002 and 010 measurement requirements	Houston, Texas	13 October	Eckmeier, Kraly, Barmore, Marks, Oder, King	S&ID, NASA
Systems integration representation for boilerplate 6 test	WSMR	13 October	Lee	S&ID, NASA
Measurement requirement and instrumentation meeting	Houston, Texas	13 October	Gillies	S&ID, NASA
Boilerplate 6 weight and balance determination	WSMR	13 October	Mann	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
United Nuclear Corporation presentation	Houston, Texas	14 October	Raymes	S&ID, NASA
Apollo manned centrifuge program meeting	Johnsville, Pennsylvania	14 October	Hornick, Armstrong, Culp	S&ID, Johnsville Human Centrifuge
Phase I development program evaluation	Louisville, Kentucky	14 October	Miller, Stefins, Daoussis, Peck	S&ID, Reynolds Metals
Field analysis	Lowell, Massachusetts	14 October	Lowery, Peterson	S&IC, Avco
Altitude indoctrination course	Edwards Air Force Base, California	14 October	Holm, Green	S&ID, USAF, NASA
Contract changes negotiation	Hartford, Connecticut	14 October	Rood	S&ID, Pratt & Whitney
Reliability missions and objectives discussion	Bethpage, Long Island, New York	14 October	Rosen, Maher, Mukai	S&ID, Grumman
Information center configuration coordination	AMR	14 October	Freeman	S&ID, NASA
Apollo SPS coordination	Sacramento, California	14 October	Borde	S&ID, Aerojet-General
Communication measurements coordination	Cedar Rapids, Iowa	14 October	Wixtrom	S&ID, Collins
Flight mechanics dynamics guidance and performance control panel	Huntsville, Alabama	14 October	Cooper, Norton	S&ID, NASA
Cost proposal field analysis	Lowell, Massachusetts	14-15 October	Lowery, Peterson, Morant, Nelson, Statham	S&ID, Avco
7th command module—service module communications and instrumentation subsystem panel meeting	Houston, Texas	14 October	Page, McQuerry, Covington, Rousculp, Hall, Nowicki, Murad	S&ID, NASA
Gemini food and waste management programs	Houston, Texas	14 October	Osborne, Duplessis	S&ID, NASA
Wind tunnel testing	Moffett Field, California	14 October	Large, Kaiserauer	S&ID, Ames
Compatibility test of the bench maintenance equipment acceptance test procedures review	Minneapolis, Minnesota	14 October	Garcia	S&ID, Honeywell
Instrumentation coordination meeting	Houston, Texas	14 October	Karl	S&ID, NASA

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 September to 15 October 1963

Subject	Location	Date	S&ID Representatives	Organization
Boilerplate 6 test preparation supervision	WSMR	14 October	Karl	S&ID, NASA
Lunar excursion module discussions	Houston, Texas	15 October	Smith, Swanson, Beeler	S&ID, NASA
Interim ordnance on boilerplate 19	El Centro, California	15 October	Ellis, Lindsay	S&ID, NASA
Lunar excursion module docking interface panel meeting	Houston, Texas	15 October	Neatherlin, Lusk, Underwood, Brown, Bohlen	S&ID, NASA
Flight technology systems meetings	Houston, Texas	15 October	Dodds, Stevens, McNary, Scottoline, Wiltse, Tutt	S&ID, NASA
Minneapolis-Honeywell qualification and life test program session	Minneapolis, Minnesota	15 October	Watson, Johnston, Radeke	S&ID, Honeywell
Fuel cell program status review	Hartford, Connecticut	15-16 October	Nelson, Nash	S&ID, Pratt & Whitney